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SELECTIONS FROM THE RECORDS

OF THE OFFICE OF THE

FINANCIAL COMMISSIONER, PANJAB.

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XLIII.—RECLAMATION OF "KALLAR" OR "REH" LAND BY MEANS OF THE MADAR PLANT.

From C. M. Rivaz, Esquire, Officiating Under Secretary to Government, Panjáb, to W. M. Young, Esquire, Officiating Secretary to Financial Commissioner, Panjáb, No. 964, dated 9th July 1872.

Forwards copy of Government of India letter (Agricultural Department) No. 251, dated 27th June and its enclosure, regarding the reclamation of "Kallar" land, with a request that the Financial Commissioner will arrange for having the experiments desired by the Government of India, carried out in different parts of the Province, especially on some of the Kallar lands along the Western Jamna Canal.

From A. O. Hume, Esquire, C. B., Secretary to the Government of India, to L. H. Griffin, Esquire, Officiating Secretary to the Government of Panjáb, No. 251, dated 27th June 1872.

I am directed to forward the accompanying copy of a communication from the Public Works Department, No. 415,I., dated 31st ultimo, and its enclosure, regarding the reclamation of "Kallar" land in certain districts of Madras by the use of the shrub *Calotropis Gigantea*, and to observe that the Ak or Madár (the *Calotropis Hamiltoni*), which is known to be abundant in Upper India, is so closely allied to the Southern Indian plant referred to, that it may be expected to prove equally effective.

2. I am accordingly to request that experiments to test its usefulness in this way, if possible, be made in the Panjab, and the results reported to the Government of India.

No. 415,I., dated Simla the 31st May 1872. Memo. from the Deputy Secretary to the Government of India in the Public Works Department, Irrigation Branch, to A. O. Hume Esquire, C. B., Secretary to the Government of India, in the Department of Agriculture, Revenue and Commerce.

The undersigned is directed to forward for information, the enclosed report descriptive of the process pursued in South India in reclaiming for cultivation "Kallar" or "Reh" land.

No. 539, dated Chingleput, the 12th February 1872, from the Sub-Engineer, No. 3 Range, Chingleput, to the Superintending Engineer, 4th Division.

On the subject of Government Order in the Public Works Department, No. 367, of 7th instant (communicated with your memorandum No. 4524 of 9th idem), wherein some suggestions are circulated by the Government of India respecting the experiences obtained in "reclaiming Kallar land" for cultivation, the Government may be interested in knowing that in South India, in the districts bordering on the coast particularly, the "reclamation" of land of the nature under notice is very readily effected by recourse to vegetable manure merely by using the well known shrub *Calotropis Gigantea*.* The land is flooded, ploughed up, and thickly covered over with the leaves and stalks of the shrub, which are trampled in ; after decomposition a second course of ploughing and flooding thoroughly reforms the land for the season. The process must be repeated for two or more seasons to render the "reclamatio[n]

* Tamil, *Yercum*; Telugu, *Jilladoo.*

permanent. Some powerful property of the shrub seems to kill (the native expression) the salts in the soil, and I have seen in my experiences over several districts very bad "Kallar" soils thus recovered. Paddy takes very fairly on the above soils after the very first doctoring. The milky juice of the *Calotropis* excites violent blistering, and its roots are used in country gun-powder manufacture; the bark yields fibre of a silken texture, and very strong.

No. 5392—93.

Financial Commissioner's Office, Lahore the 25th July 1872.

Copies of the foregoing forwarded to Commissioners, Dehli and Lahore, for information, with a request that they will be good enough to have the experiment tried, and report at the close of the next Rabí crop what the effect has been.

From Lieutenant Colonel J. E. Cracroft, Commissioner and Superintendent, Dehli Division, to J. A. E. Miller, Esqiure, Secretary to Financial Commissioner, Panjáb, No. 154, dated 16th July 1873.

With reference to No. 5392, dated 25th July 1872, has the honor to forward precis of correspondence regarding reclamation of Kallar land.

Epitome of the reports of the Deputy Commissioners of the Dehli Division, on the subject of the reclamation of Kallar land.

DEHLI.

Major Tighe reports that the experiments have been made by the Tahsildars in Dehli for the kharíf of this year, but the result will not be known until after next October.

GURGAON.

Mr. Oliver reports :—

1st. There is very little Kallar land in this district to make the experiment, if successful, worth application.

2nd. The results (system laid down in enclosure of Financial Commissioner's No. 5392, dated 25th July 1872,) did not prove satisfactory, and the experiments failed more on account of the people employed in making the same, not taking the interest they would have done had the Kallar land been more extensive, and by the reclamation of which benefit was to be derived.

Reports that "Ak" or "Madár" plant does not grow extensively in the district. The character of the soil of the district more sandy than "Shorí" Kallar. The watering of beds experimented on, was from wells, and never was sufficient to decompose the vegetable matter—hence chief cause of failure.

Experiments were carried on by Tahsildars and two or three of these places were visited by Deputy Commissioner.

KARNAL.

Captain Harcourt reports that experiments were tried in two instances, both of these pieces of land were bordering along side of Western Jamná Canal, and experiments conducted by Gholám Hosein Khan, Naib Tahsildár of Karnál. One portion of Kallar land situated at Rajpúr on the bank of Western Jamná Canal measuring five biswás was levelled so as to admit the water and allow the same to remain, when thoroughly saturated the soil was ploughed up and barley sown. Not a single seed germinated. Another piece of Kallar land was also flooded, ploughed up, and then thickly covered with leaves and stalks of the "Madár" shrub. A manure of Til and mustard "Bhoosá" was then trampled into this soil, and ploughing and flooding were again had recourse to, but the "barley" that was sown never showed above the surface. The extent of Jhils, useless morass, and unprofitable soil is great in Karnál and chance of improving it should not be rejected, though in two instances the experiments failed. Promises to conduct further experiments under his own supervision with a view of reclaiming all the swampy grounds of the district which cause the prevalence of disease in the district.

COMMISSIONER'S REMARKS.

No sufficient test of the value of the experiments has been applied anywhere.

(Sd.) J. E. CRACROFT,
Commissioner.

From Lieutenant Colonel R. Young, R. E., Officiating Commissioner and Superintendent, Lahore Division, to J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, No. 292, dated 2nd July 1873.

In reply to his No. 5393, dated 25th July 1872, submits reports in original by Deputy Commissioners, Lahore and Firozpúr.

2. It is now an ascertained fact that Madár does kill Kallar and that the land owners of this province did not know it. There are not many localities in which the Madár grows in such quantities near Kallar land that the cure can be applied with good profit, but it is well to have spread the idea.

From Captain R. P. Nisbet, Deputy Commissioner, Lahore, to A. Brandreth, Esquire, Commissioner & Superintendent, Lahore Division, No. 399, dated 28th May 1873.

Referring to your Circular 104—2034, dated 3rd August 1872, I find that no experiments have been made as therein desired as to the efficacy of the "*Calotropis Hamiltoni*" in eradicating Kallar from the soil in land so affected in this district.

I have had up a good many of the Chowdrís and leading agriculturists and discussed the matter with them, and they allege first that in the neighbourhood of Kallar lands in this district there is no abundant growth of the *Calotropis Hamiltoni* to admit of a trial being made, but more than all they unanimously state that irrigation with canal water has done much to reclaim Kallar lands in this district, and that after three waterings the soil becomes culturable and that much Kallar land has been thus brought under cultivation. They also object to the handling of the "*Calotropis Hamiltoni*" which when briused they declare produces violent blistering of the skin to all who touch it with hands or feet.

From Captain R. P. Nisbet, Deputy Commissioner, Lahore, to A. Brandreth, Esquire, Commissioner and Superintendent, Lahore Division, No. 420, dated 10th June 1873.

In reply to his No. 365—1671, dated 7th instant, states that in the Lahore district, there is a considerable difference in the "Kallar" land according as the locality developes in a greater or less degree, the efflorescence of saltpetre, and in proportion as the soil is thus more or less impregnated, the flooding with canal water has to be repeated, and the affected area is slower in producing crops of any value. On the hard Kallar, after copious watering the "*Suœda Fusticasa*" vernacular "Laná" springs up, and where this is found in the 2nd or 3rd year rice may be cultivated. There are Kallar tracts which again it is hopeless to reclaim.

From Lieutenant Colonel P. Maxwell, Deputy Commissioner, Firozpúr, to A. Brandreth, Esquire, Commissioner and Superintendent, Lahore Division, No. 125, dated 20th May 1873.

Your No. 104—2034, dated 3rd August 1872, Reclamation of "Kallar" land by "*Calotropis Hamiltoni.*"

Experiments have been tried in 7 different villages in this district. In four of them the result was said to be favorable ; in three of them little success resulted.

2. I propose to endeavour to continue the experiments, and to urge the people to do so.

From Major F. J. Millar, Deputy Commissioner, Gujránwála, to Lieutenant Colonel R. Young, R. E., Officiating Commissioner and Superintendent, Lahore Division, No. 263, dated 30th June 1873.

In reply to his Circular No. 84—1568, of 27th May 1873, and Circular No. 104—2034, of 3rd August 1872, Reclamation of "Kallar" land by "*Calotropis Hamiltoni*" has the honor to state that experiments were made in five different villages with the following result :—

In one place three maunds of barley were produced from two kanáls of land, in the other place from one kanál of land the yield of poppy was more than the average produce from good land for poppy cultivation. In the three other places the result was not favorable.

No. 301—1969, dated 4th July 1873.

Commissioner's Office, Lahore Division.

Copy of the above forwarded to J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, for information in continuation of No. 292—1924, dated 2nd instant.

From J. A. E. Miller, Esquire, Secretary to Financial Commisioner, Panjáb, to B. Ribbentrop, Esquire, Officiating Conservator of Forests, Panjab, No. 4773, dated 14th July 1873.

With reference to the enclosed correspondence received from Government, the Financial Commissioner will be glad of your opinion as to whether there is any truth in the theory that the "Madár" plant (*Calotropis Hamiltoni*) when worked into "Kallar" land in the manner described has the property of eradicating the "Kallar" or saline efflorescence.

From B. Ribbentrop, Esquire, Officiating Conservator of Forests, Panjáb, to J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, No. 43C., dated 20th July 1873.

With reference to your No. 4773, of 14th July, I have the honor to reply that I am not able to give the information asked for, "whether the Kallar is eradicated in Kallar land by the working in of *Calotropis Hamiltoni.*"

I have, however, observed at Changá Mangá that the decomposition of any vegetable matter has a beneficial influence on such lands. The salts are apparently dissolved by the carbonic and other acids which are formed in course of the decomposition, and seem to produce solutions harmless to vegetation. I will make experiments as required in Government letter No. 257, and furnish you with a full report on the subject in question.

From J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, to Doctor T. E. B. Brown, Secretary to Agri Horticultural Society, Lahore, No. 5334, dated 7th August 1873.

I am directed to forward copies of correspondence received from Government, on the subject of the use of the Madár plant in counteracting the effects of Reh efflorescence in the soil, and to request the favor of your opinion as to whether there is any truth in the theory.

2. As far as enquiry has yet been made the evidence in favor of the theory is not conclusive, but the question is important for many parts of the Panjáb, and there is ample room for further enquiry and experiment.

From Doctor T. E. B. Brown, Secretary to Agri Horticultural Society, Lahore, to J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, dated 24th August 1873.

In answer to your office letter No. 5334, dated August 7th, and its enclosures, with reference to the use of the Madár plant in counteracting the effects of the Reh efflorescence, I have the honor to offer the following remarks :—

1st. Many soils containing Reh may be reclaimed by repeated floodings and application of manure, either of leaves or of other substances. This has been shown in the gardens of the Agri Horticultural Society at Lahore, which were formerly greatly injured by Reh, but are now little effected by it, and it is probable that this process may be more readily carried on in Southern India, where the rains are more profuse than in the Panjáb. It is, however, stated that the Madár plant contains a large proportion of the Nitrates of lime and potash, and these salts may be of service in neutralising the Reh as will be subsequently shewn.

But it is certain that the Reh cannot be killed, as the writer of the paper suggests, by the acrid effect of the milky juice of the Madár, although this is poisonous to many animals, since Reh has no resemblance to a living substance, but is a chemical product without life. Reh consists of a mixture of sulphate and carbonate of soda with chloride of sodium in various proportions, it is also often mixed with various substances derived from the soil.

A peculiarity of the sulphate and the carbonate of soda is that these salts melt in their water of crystallization at the temperature of 96,° and consequently Reh liquifies and sinks into the ground during the hot season in the Panjáb. Another peculiarity, which the above salts share with some other salts of soda, is that they effloresce or give off their water of crystallization when exposed to cold dry air so that during the cold weather the salts form a white powder, which covers the ground, and which readily absorbs moisture, and again gives it off to the air, and thus keeps the ground dry. While if the water is added in larger amount, the Reh dissolves and forms a strong solution, which prevents the absorbtion of liquid by the plants, and thus stops their growth, and at last their life. It is probable also that the carbonate of soda at least may be of direct injury to plants, as it dissolves many organic substances, but even this salt when it is sufficiently diluted is quite innoxious, as is shewn by the gardens of the station at Lahore, many of which are irrigated from wells, the water of which contains some carbonate of soda.

If therefore the amount of water added to a Reh soil is very large, it would form a solution which would not injure plants, unless by the amount of water present. This has happened in the gardens of the Agri Horticultural Society.

Further if good drainage can be conjoined with a large supply of water, this will materially assist in removing Reh from any spot, as the solution will be taken away from the ground by draining, as fast as it is formed, and unless there is a large supply of salt under the soil, the Reh will at last entirely disappear from that ground. This process probably assists the removal of the Reh in Southern India near the sea, where the rainfall is usually abundant and the drainage probably good.

In many parts of the Panjáb, however, the rains are scanty, drainage is defective, and water can seldom be obtained in sufficient quantity by artificial irrigation

to wash out the salts of Reh. Another way in which the effects of Reh may possibly be neutralised, is by altering the composition of its salts, so that the salts formed should have no tendency to effloresce.

The salt which I have recommended for this purpose is the nitrate of lime, which forms with sulphate of soda, nitrate of soda and sulphate of lime, and with carborate of soda, nitrate of soda and carborate of lime. Of these salts nitrate of soda actually attracts water from the air or is deliquescent, while both sulphate and carborate of lime are sparingly soluble in water, and are neither efflorescent nor deliquescent. I subsequently found that the "Chikná Kallar," which natives use in some places to remedy the ill effects of Reh, contains nitrate of lime. Hence if Madár leaves contain this salt, nitrate of lime, they may be useful in neutralising the Reh by effecting the decomposition above described.

But this same salt is always formed when organic matter containing nitrogen, such as common manure, is exposed to the action of the air, water, and lime or its carbonate, and as the latter exists in all soils, it is probable that by manuring and watering Reh land it would be rendered productive after a time, and as the leaves of the Madár and other plants contain nitrogenised matter this would still further assist in destroying the Reh, but in my opinion it is probable that leaves would be less effectual than manure, since they contain much less nitrogen. It should also be stated that when soils containing Reh are once brought into a condition to support vegetation, that every plant grown will take up a portion of the Reh salts, and incorporate it with the structure of the plant, and if the plant is removed for food or other purposes the ground will be rendered less saline. This is most readily affected by growing plants for fodder, especially grasses on Reh land, as whenever the grass is cut a certain proportion of the salts are removed with the leaves.

I would therefore conclude that the treatment of Reh lands by the leaves of the Madár may succeed from the following circumstances :—

1st. From the repeated irrigations assisted by the natural rainfall and perhaps by drainage.

2nd. From the plant containing the nitrates of lime and potash in its leaves which neutralise Reh.

3rd. Partly from the Madár leaves forming nitrate of lime during their decomposition.

But its applicability to the Panjáb would depend on the comparative cost of collecting Madár leaves, and of buying manure in different districts, in which the necessary irrigation could be effected, and also on the comparative effect of these different plans of manuring on the Reh, and I am inclined to think that it would only be applicable where manure is dear while Madár leaves and water are very abundant.

From J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, to T. H. Thornton, Esquire, Secretary to Government, Panjab, No. 1009, dated 16th September 1873.

I am directed to reply to your letter No. 964 of 9th July 1872, regarding the reclamation of "Reh" or "Kallar" land by means of the Madár plant.

2. The papers were sent to the Commissioners, Dehli and Lahore, with instructions to try experiments in lands affected by Reh efflorescence, and subsequently the opinions of the Conservator of Forests, and the Secretary to the Agri-Horticultural Society were taken.

Experiments were tried in the three districts of the Dehli Division.

In the Dehli district the experiment was made with the autumn crop, and the result is not known yet.

In Gurgáon the experiments failed. Kallar land is not common in this district, and the Madár plant is not abundant.

In Karnál the experiments failed also, but are to be repeated.

The Commissioner remarks that no sufficient test of the value of the experiments was made in these three districts.

3. The Commissioner Lahore, concludes from the result of experiments in his division that the efficacy of the Madár plant in counteracting Reh and Kallar is established. The information on which this conclusion is based is not, however, very complete.

In the Lahore district, no experiments were made. The Madár plant is said to be not abundant in the neighbourhood of Kallar lands.

The continuous use of canal water has been found to reclaim land from the effects of Kallar. The Deputy Commissioner remarks that the natives object to handle the Madár plant on account of its blistering qualities.

In Gujránwálah experiments were tried in five villages. In three of these the result was not favorable. In the other two the land treated with Madár produced in one case a tolerable crop of barley, and in the other a good crop of poppy.

In Firozpur experiments were made in seven villages, in four of which a good crop was obtained, and in three little success resulted. The experiments are to be continued.

4. The Officiating Conservator of Forests (Mr. Ribbentrop) has observed that the decomposition of any vegetable matter has a beneficial effect on Kallar lands. He has not, however, tried the Madár plant, and promises to do so and furnish a report.

Doctor Brown has also observed the good effects of flooding and the use of vegetable manure in counteracting Reh efflorescence; the flooding must, however, be accompanied by good drainage so as to carry off the salts of the soil. The best agent in Doctor Brown's opinion for neutralising Reh is nitrate of lime. He has found that the "Chikná Kallar" which natives use to counteract Reh contains nitrate of lime, and he thinks that if Madár leaves are found to be efficacious in neutralising Reh, it must be because they contain nitrate of lime and because they probably form nitrate of lime during decomposition. But to say that the Madár "kills" the Reh is not strictly correct, as the Reh is an inorganic chemical product.

Doctor Brown's letter, dated 24th August 1873, which is forwarded herewith, is interesting and valuable, being founded not only on scientific knowledge, but also on practical experience.

5. The general result of the enquiry is that the Madár plant has no appreciable advantage over other forms of vegetable manure, and that whatever manure is used it must be supplemented by flooding and drainage in order to carry off the Reh.

The experiments that have been undertaken in districts have been directed too much to merely observing whether crops will grow on lands affected by Reh, when manured with Madár leaves, and not sufficiently to the effect of the Madár leaves in diminishing the visible presence of Reh. It cannot be expected that land largely impregnated with Reh will be cured in one season by the use of Madár leaves, or produce a plentiful crop at once.

The report on the Madras experiment shows that the treatment has to be repeated for two or three seasons.

6. The Madár plant does not always grow in or near Reh lands, and this creates a difficulty in some places in carrying out the experiments. In the neighbourhood of Lahore, however, Reh lands are common, and the Madár is usually obtainable within easy distance. Experiments conducted at Lahore, in the gardens of the Agri Horticultural Society and other lands under the supervision of the Secretary, Doctor Brown, would be the best means of continuing this enquiry and arriving at a sound conclusion.

From T. H. Thornton, Esquire, Secretary to Government, Panjáb, to J. A. E. Miller, Esquire, Secretary to Financial Commissioner, Panjáb, No. 1461, dated 6th October 1873.

I am directed to acknowledge the receipt of your letter No. 1009—6151, dated the 16th ultimo, reporting on the results of the experiments which have been made during the past year in the Dehli and Lahore Divisions for the reclamation of "Kallar" lands by means of the Madar plant.

2. No great degree of success appears to have as yet attended these experiments, but a sufficient trial has not been made, as the process requires to be repeated for two or more seasons. The experiments should accordingly be continued in those districts where they have been already instituted, and should also be made under the supervision of the Conservator of Forests and the Secretary to the Agri Horticultural Society.

3. Copies of the Financial Commissioner's report, and the interesting letter from Doctor Brown which has accompanied it, will be forwarded to the Government of India.

Report by W. J. Ward, Esquire, extracted from Selections from the Records of Government, North Western Provinces, Vol. II No. II of 1869, page 211.

Improvement of "Reh soils." Remedies suggested.

In answer to the enquiry "what can be done to improve Reh soils?" various remedies are proposed, such as flooding, sweeping, sub-soil ploughing, cultivation of soda-consuming plants (if any such be known to the Botanist suitable to the conditions of growth and climate), planting of trees which can live in such land, as "Kikur," chemical means, such as the use of nitrate of lime; but after all, the real practical remedy appears to be irrigation accompanied with efficient drainage. The reduction of the amount of the salts within harmless limits by their absolute separation from the soil seems the only certain cure. Water, the cause of the efflorescence, is the only effective means for its removal; that it can and does dissolve out the saline constituents, is rendered evident (if proof were needed) by the results obtained from the various soils treated with it; and from the water taken from Pit No. 3, every drop of water percolating through the soil, and passing away, will carry with it those portions of the excess of salts existing in the soil with which it comes in contact. This would be equally the case whether the percolation be from above downwards, from below upwards, or in a horizontal direction. Hence it is probable that the percolation of the canal waters has considerably purified the strata through which it passes, and has produced a corresponding accumulation in other parts. There is no ground for apprehension lest a soil can be impoverished by water as none of the ingredients necessary for the growth of plants are removed in any appreciable quantity. To obtain the full advantage of the treatment of Reh soils with water, it is of course evident that the water must be applied in such quantity as to drain off, and that the means for its doing so must be provided.

Water the only effective means of removing "Reh."

Report by Dr. A. Fleming, dated 3rd April 1853, extracted from Select Papers of the Agri Horticultural Society, Panjáb, page 248.

I see in the last report of the Meeting of the Agri Horticultural Society an extract of a memo. by R. Egerton Esquire, C. S., on the saline efflorescence on the soil around Lahore, and on the application of "old mortar and crumbled brick" as an antidote employed by the natives to counteract its injurious effect on the crops. It would be interesting to ascertain in how far the virtue of the antidote is ascribable to the lime of the mortar or the burnt brick, and whether the rubbish usually selected as a top dressing to the young crops does not contain a large portion of nitrogenous matter. Not only at Lahore, but throughout the Panjáb, a very common top dressing to young crops, partly as a manure and partly as an antidote to the Reh or Kallar (saline efflorescence) on the soil, consists in the scrapings of roads and of sheep pens, &c. These have always appeared to me to owe their chief virtues to the nitrogenous principles they contain in abundance.

Since 1846, I have had occasion to examine analytically the saline efflorescence on the soil in various parts of the Panjáb, the Lahore district included, and have invariably found it to be a mixture of sulphate of soda (Glauber salts) and common salt in varying proportions. The efflorescence invariably gives an alkaline re-action indicative of carbonate of soda; but this salt, as far as I have observed, occurs in small quantity and is practically unimportant.

From the above it is evident that to render soil fertile, which contains a large amount of Kallar, some chemical antidote must be applied, which by double decomposition will convert the noxious salts into others having a less injurious and perhaps salutary effect on vegetation.

The effects of top dressing with road scrapings, sheep dung, and other nitrogenous manure seems to me to be to convert the salts of the original Kallar into nitrates, which in many plants have a far less injurious effect than sulphates and muriates. The calcarious matter too in road scrapings and mortar rubbish, when mixed with the Kallar, would give rise to the formation of sulphate of lime (gypsum) in some circumstances a most valuable manure.

I have not had leisure nor means to experiment largely on the subject under notice, but would suggest that the Society should institute a series of experiments on a patch of Kallar ground near Lahore, with the view of testing whether the abundant application of nitrogenous manure, such as dead animals, urine, ordure, &c., (the jail might supply abundance) will counteract the injurious effects of the ordinary saline efflorescence which is so destructive to the fertility of the soil over vast tracts of the Panjáb, particularly affecting those districts where water for irrigation is derivable from wells or rain.

Researches of the above nature are, I conceive, the chief object of a Society such as ours, and it is pleasing to observe the general departments of agriculture receiving now more prominent attention at the Meetings of the Society than at first start they appeared to do.

I may here mention that throughout the desert alluvial tracts of the Panjáb wherever the saline efflorescence is abundant, its presence is invariably marked by an abundant crop of Lána, (a species of Salsola,) which on being burnt, yields the Sají (an impure carbonate of soda) of your bazars. This is particularly abundant over the alluvial tracts skirting the salt range and Súlemán mountains, which, in dry seasons like the present one, are nearly desert, but which, were canal irrigation available, might be rendered extremely fertile.

I ought to have mentioned, that irrigating Kallar lands by river water is perhaps one of the simplest, cheapest and most effectual methods of removing the Kallar or counteracting its injurious effects. Where canal irrigation and lime are not available, we must call in the aid of chemical antidotes.

Extract from Select Papers of the Agri Horticultural Society, Panjáb, page 82.

This saline efflorescence exists, in isolated portions of several districts, in such abundance as to be wholly inimical to vegetation. The land lies waste and covered with a film of crystalized particles as white as snow. Not only is the soil impregnated, but the spring water from wells, if used for irrigation only increases the evil.

A detailed analysis of this substance might be suggestive of a remedy, but in whatever proportions composed, there is no doubt, that it consists of alkaline salts, and that a corrective must be sought by the application of acids to combine with the alkalies and form new compounds, which would not be detrimental to vegetation, and might prove advantageous to it. In some parts of the country, where this substance is in great measure or wholly deficient, it is sought for from old mcunds and applied as manure. It is, therefore, the excess only, in other places, which is so injurious. The acid liquor formed during the fermentation of vegetable substances might be tried as a cure. This could be readily and cheaply procured by the cultivator; acetic acid being generated in the water in which hemp stalks are soaked, as well as in indigo vats. The result of the application of this acid to carbonate of soda (of which the natural efflorescence is believed to consist) would be to form acetate of soda to a certain extent, and to set carbonic acid free. The effect of acetate of soda on vegetation remains to be shown: but another combination of soda might be produced in the following manner :—

In the decomposition of animal matter, nitrogen gas is evolved to a considerable extent, which, uniting with the oxygen of the atmosphere, nitric acid is produced. This, in contact with carbonate of soda would form nitrate of soda, which is a well tried and very valuable manure. No cultivator can be at a loss for animal substance for such a purpose. Carcasses of cattle are exposed, and pollute the air near every village. If earth impregnated with the substance under consideration, and the efflorescent salt itself were collected and heaped on dead animals of any description, a manure would be formed which in time would cover large tracts of land, now barren, with the richest cultivation.